# SOCIETAL RESPONSES

## MANAGING COASTAL RESOURCES


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In 1972, the U.S. Congress passed landmark legislation encouraging coastal states to use their full authority for the wise management of coastal resources and development. Today, 32 states, territories, and commonwealths manage more than 99% of the nation's shoreline with comprehensive, federally approved programs. The coastal areas managed range from the arctic to tropical islands, from sandy to rocky shorelines, and from urban New York City to rural Oregon. Coastal resources and management issues differ from state to state, and no state, territory or commonwealth manages its resources in exactly the same way. Yet all state coastal management programs share a common objective: to balance economic development with their trustee responsibilities to protect public resources.

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The following reference format is suggested:

National Oceanic and Atmospheric Administration (NOAA). 1998 (on-line). "Managing Coastal Resources" by William C. Millhouser, John McDonough, John Paul Tolson and David Slade. NOAA's State of the Coast Report. Silver Spring, MD: NOAA.

URL: http://state-of-coast.noaa.gov/bulletins/html/crm_13/crm.html

# INTRODUCTION

Managing coastal resources wisely means guiding the use of coastal lands and waters in a way that protects resources for future generations while allowing coastal communities and economies to thrive. Coastal managers face a broad array of issues, as well as several federally mandated objectives (Table 1 ).

**Table 1. National objectives of coastal resources management**

- Protect natural resources
- Manage coastal development to reduce the impact of natural hazards
- Protect and restore coastal water quality
- Provide public access to the coast
- Give priority consideration to coastal-dependent uses and orderly siting of major facilities
- Encourage urban waterfront and port redevelopment, and historic and cultural preservation and restoration
- Support comprehensive planning and management for living marine resources
- Plan for the effects of land subsidence and sea level rise
- Coordinate and simplify governmental decision-making
- Encourage public participation in coastal management decisions.

Source: Coastal Zone Management Act of 1972, as amended, 16 USC §§ 1451 et seq.

Achieving these objectives requires the combined efforts of the Federal government, the coastal states, thousands of local jurisdictions, nongovernmental organizations and the public. The Coastal Zone Management Act of 1972 (CZMA) offers the most comprehensive approach, both geographically and substantively, to this management challenge. This essay discusses the major uses, resources and pressures in coastal areas, as well as the most prominent techniques used to manage them.

Photo 1. This undeveloped barrier island is in dramatic contrast to the heavily developed barrier island immediately to its north, shown in Photo 2. These images are reminders of what the U.S. coastline once was, and what it can become.

Photo 2. Resources such as this heavily developed barrier island and its surrounding waters and wetlands are the focus of coastal management in the United States.

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## Coastal Resources and the Need for Management

Coastal areas require management because of the richness, diversity and sometimes scarcity of resources–wetlands, beaches, dunes and barrier islands, estuaries and other coastal waters, coral reefs, mangrove forests and other living marine resources–and their economic importance to the nation.

Competition and conflict among the numerous uses of the coast increase the need for management (Table 2). The coast is home to over half the nation's population (Culliton, 1998), is a popular vacation destination, provides key transportation avenues for over 90% of U.S. international trade (NOAA, 1995), and supports over $56 billion in commercial and recreational fishing activity each year (NOAA, 1994a). Brief descriptions of some coastal resources and management issues of national interest are found in Appendix A.

Photo 3. The demand for public access to coastal waters makes the protection and availability of beaches a national coastal problem.

## Coastal Uses

Coastal programs address competing needs for resources, steer activities to appropriate areas of the coast, and minimize the effects of these activities on coastal resources. States manage uses through their planning and regulatory authority over a specific use or area. Major uses subject to management include residential, commercial, recreational and industrial development; harbor development and maintenance, such as channel dredging and dredged material disposal; mineral extraction for oil, natural gas and hard minerals; erection of structures to "control" shoreline erosion; and commercial and recreational fishing (Table 2).

**Table 2. Management issues**

***Coastal Resources and Habitat Type***
- Wetlands
- Watersheds
- Estuaries
- Beaches/Dunes/Barrier Islands
- Coral Reefs
- Mangroves
- Fish and Invertebrates
- Shorebirds and Waterfowl

***Pressures***
- Coastal Population Growth
- Water and Air Pollution (inland and coastal sources)
- Marine Debris
- Storms
- Chronic Erosion
- Changes in Sea and Great Lakes Levels
- Overfishing

***Uses***
- Coastal Development
- Public Access/Recreation/Tourism
- Mineral Extraction/Oil and Gas Drilling
- Shipping/Ports and Harbors
- Agriculture/Forestry
- Aquaculture/Mariculture
- Fishing
- Cultural/Historic Preservation and Restoration

***Problems***
- Water Quality Degradation
- Harmful Algal Blooms
- Coastal Hazards
- Loss and Fragmentation of Habitat
- Species Decline/Loss of Biodiversity
- Aquatic Nuisance Species Invasions

Limited Public Access
Fishery Collapse and Closure

In addition to coastal use issues such as the location and density of public and private structures, coastal managers must address problems related to the use of "common property" (Uravitch, 1996). The public trust doctrine (PTD) gives many common property resources and uses special treatment. Derived from Roman civil law, English common law, American colonial law, state law, federal law and the courts, the PTD provides that states hold in trust for public benefit their navigable waters, the lands beneath them and the living resources dwelling in them, and that the public has a right to use and enjoy these waters, lands and resources for a wide variety of uses (Slade et al., 1990). The protection of public beaches and the development of state-owned submerged lands for energy, marine transportation and marine recreation are responsibilities that arise under this doctrine.
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Photo 4. Coastal areas managed in the United States range from these undeveloped rocky headlands in Oregon to heavily urbanized areas of the Northeast.

## Management Techniques

State coastal managers use many different management techniques (Table 3). Regulatory measures such as permits, zoning ordinances and building codes are the primary elements of state programs to protect coastal resources. States also make wide use of incentives, voluntary programs, land acquisition, planning, public education and intergovernmental coordination. Section 307 of the CZMA, which requires federal agencies to conduct their activities in ways that are consistent with state coastal management programs, is also a key management technique. However, resource management priorities, management techniques, and organizational structure differ from state to state.

**Table 3. Management techniques**

***Research/Assessment***

Resource Assessments
Inventory and Mapping
Geographic Information Systems
Habitat Restoration Research
Sea Level Rise Research
Beach Profile Development
Remote Sensing

***Land and Water Management***

Land Acquisition
Conservation Easements
Public Access Development
Restoration/Enhancement
Public Investment Restrictions
Coastal Property Disclosure

***Planning***

Local Land-use Plans
Special Area Management Plans (SAMP)
Regional Plans
Public Access Management Plans
Disaster Preparedness Plans

***Regulation***

Setbacks/Buffers
Special Use Permits
Shoreline Stabilization Restrictions
Local Zoning Ordinances
Compensatory Wetland Mitigation
Mitigation Banking
Wetland Permits
Development Permits

***Education***

Technical Assistance to Landowners and Government
Publications, Video and Other Media
Workshops and Conferences

***Intergovernmental Coordination***

Federal Consistency Procedures
Operating Agreements

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# NATIONAL PICTURE

## The Coastal Zone Management System

The Coastal Zone Management Act of 1972 (CZMA) establishes a partnership between the federal government and the state governments (including the territories and commonwealths) for management of the coast. States develop and implement coastal zone management (CZM) programs with enforceable policies designed to meet national objectives (see Table 1). The federal government provides funds to implement these management programs and requires federal agencies to act consistently with federally approved state CZM programs.

Photo 5. This Georgia barrier island is part of a chain of 400 barrier islands that form a protective fringe for the coastal mainland from Maine to Texas.

To obtain federal approval of their CZM programs, states must define a coastal zone boundary, designate critical areas of concern based on a coastal resource inventory, and adopt enforceable policies to address their most important objectives. Many states also work with local governments to ensure that local plans and ordinances are consistent with state and national CZM issues. The federal government, through NOAA, provides coastal states with guidance and information to support their management activities (see Table 3). In consultation with the states, NOAA also makes and influences national policy on coastal issues and establishes partnerships to address national and regional concerns. Important sections of the CZMA are summarized in Table 4.

**Table 4. Important Sections of the Coastal Zone Management Act (CZMA)**

| Section | Description |
|---|---|
| 305 | Provides funds for the development of state CZM programs |
| 306 | Provides funds for states to administer federally approved CZM programs |
| 307 | Requires federal agencies to be consistent in their programs and activities with federally approved state CZM programs |
| 309 | Provides funds for state projects or programs that meet at least one of eight national coastal zone enhancement objectives |
| 312 | Mandates periodic federal evaluation of federally approved state CZM programs |
| 315 | Establishes a system of estuarine research reserves to promote public understanding of coastal ecosystems and estuarine research |

To date, 32 of 35 eligible states, representing more than 400 coastal counties and thousands of municipalities (Clark, 1995), have joined the national CZM system (Figure 1). Washington became the first state to participate, joining in 1976, while Georgia is the most recent, joining in 1998. The CZM system represents the full range of coastal ecosystem types from Arctic Alaska to tropical islands, from sandy to rocky shorelines, from urban New York City to rural Oregon and the associated management issues.

The Coastal Zone Act Reauthorization Amendments of 1990 broadened the CZM program. The free-standing provision Section 6217 directs states to develop coastal nonpoint programs to address sources of polluted runoff, including urban facilities, agriculture, forestry, marinas, and hydromodification such as channelization and dam construction and operation. To date, 29 states with federally approved CZM programs have developed coastal nonpoint programs.
(top)

## Area Managed

***State Coastal Zone Boundaries*** . The Submerged Lands Act establishes the seaward boundary of a state's coastal zone, typically three nautical miles from shore or to the international boundary with Canada in the Great Lakes. Landward boundaries vary by state, but must extend inland far enough to include specific coastal resources such as wetlands and address uses that have a significant impact on coastal waters (CZMA §304). Different states define this boundary in different ways, such as distance from shore, coastal watersheds, elevation, coastal counties or coastal highways (Figure 2). For example, Florida's coastal zone includes the entire state, while Puerto Rico's extends inland 1,000 meters from the shore. The coastal nonpoint program boundary is different from the CZM program boundary and, in many cases, includes coastal watersheds.

***Shoreline Length and Coastal Area.*** Over 99% or 95,439 miles (153,594 kilometers) of the nation's shoreline is managed by federally approved state CZM programs. Even without Alaska and Ohio, for which data were unavailable, the land area in CZM programs involves approximately 171,062 sq mi (443,051 sq km), an area slightly larger than the state of California. State areas range from 76 sq mi (197 sq km) for the entire territory of American Samoa to 52,300 sq mi (135,000 sq km) for Florida (Appendix B) (Farrow et al., 1992).
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## Management Issues of Concern to States

All coastal states must deal with the effects of coastal development on hazards, habitats and public access. The relative importance of these issues in each state depends on factors such as the amount and spatial distribution of coastal resources and the variety and intensity of conflicting activities proposed for the coast. State CZM funding priorities reflect these differences in management emphases. For example, Alaska, with very low population density, has spent little CZM money on public access, whereas Pennsylvania, with very high coastal population density, has spent 34% of its federal CZM money on public access projects.

The areas of their programs that states choose to strengthen through enhancement grants under Section 309 of the CZMA also suggest the relative importance of particular issues in particular states. The management issues receiving additional attention by coastal states are (1) preservation of wetlands (24 states); (2) coastal hazards (22 states); (3) public access (14 states); and coastal development (all 32 states). In addition, two states, three territories and two commonwealths focus efforts on protecting and preserving coral reefs (Appendices C and D).
(top)

Photo 6. Coastal hazards such as this eroding Lake Erie bluff are concerns in most coastal states.

## State Coastal Zone Management Structure

There are five types of CZM programs, ranging from those originating in comprehensive legislation to those consisting of a "network" of state and local agencies with different management authorities. They are:

**1.** ***Direct*** . A single state agency implements comprehensive regulations and issues permits for activities in the coastal zone. (6 states)

**2.** ***Direct/Local Coastal Program (LCP)*** . A single state agency has comprehensive regulatory authority, but can delegate specific permitting responsibilities to qualifying local government agencies that develop local coastal programs (LCPs). (3 states)

**3. *Networked*** . A single state agency coordinates the activities of other state and local agencies that have specific permitting and regulatory authority in coastal areas. Typically, an executive order or coordinating legislation establishes this type of program. (12 states)

**4. *Networked/LCP*.** A single state agency coordinates the activities of other state and local agencies that have specific permitting and regulatory authority in coastal areas. In addition, they have enforceable LCPs. (7 states)

**5. *Networked/Regulatory*** . A lead state agency shares regulatory authority with other state agencies for managing specific activities that take place within the coastal zone. (4 states)

Sixteen of the 32 states have passed comprehensive legislation that provides program authority and guidance, regardless of the program type. Appendix E lists the coastal states, notes their type of CZM program, and identifies those that have comprehensive coastal legislation (NOAA, 1997a).
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## Financial Resources

Over the past 25 years, more than $1.6 billion in federal and state matching funds, an average of $67 million per year, in federal and state matching funds have been appropriated to help support coastal management activities under the financial assistance provisions of the CZMA. This figure does not include state and local funds appropriated in excess of the state matching funds required for federal coastal management grants, nor does it include federal funds needed to administer the CZMA and money spent by a host of federal agencies to coordinate their activities with state activities in the coastal zone.

In 1997, state CZM program grants totaled $87 million. Of this, $48 million were federal funds, while $39 million were state funds. Although states are generally required to contribute an amount equal to the federal grant awarded to implement their coastal management programs, federal grants under Section 309 of the CZMA do not require state matching funds. The demand for federal funding is likely to increase as the remaining states receive program approval. Over 1,100 state employees, or about 34 persons per state, actively implement state coastal management programs. An uncounted number of planners, zoning administrators, building code officers, natural resource managers and support personnel help administer state programs at the local level (NOAA, 1997b).
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## Management Techniques

The variety of techniques used by the states to address major coastal management issues of national interest–estuary and coastal wetlands protection; hazards reduction; beach, dune, bluff and rocky shores protection; public access to the shoreline; and coral reef protection–can be broken down into four categories: regulation; planning; land and water management techniques; and research and assessment. Appendices F, G, and H also summarize management techniques used for wetlands protection, hazard reduction and public access.
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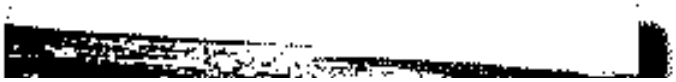

Photo 7. All coastal states with federally approved coastal management programs regulate the alteration of coastal wetlands.

***Estuary and Coastal Wetlands Protection*** (from Good et al., 1997)

Estuaries and coastal wetlands (both tidal and nontidal) are among the most productive ecosystems, yet more than half of all the wetlands that existed in 1780–221 million acres–have disappeared as a result of filling, draining, damming and other conversions (Dahl, 1990). Pressures on remaining coastal wetlands continue from agricultural and urban runoff, as well as filling and draining. Coastal states are using dozens of methods to protect, preserve and restore estuaries and the remaining coastal wetlands. Principal among these are:

*Regulation.* All states have local zoning ordinances, permit requirements or equivalent systems to regulate the alteration of coastal wetlands. Most states have a "no-net-loss" policy intended to halt any further loss of wetlands. Twenty-two states require that buildings be set back from wetlands to provide buffer areas between development and the resource.

*Planning.* Twenty-eight states rely on traditional tools such as local land use plans and special area management plans to protect coastal wetlands. These plans provide specific guidance on the activities and uses that are acceptable in various areas. About one-third of the states have experience in mitigation banking, a technique in which wetland enhancements offset or mitigate the loss of wetlands through development activities.

*Land and Water Management Techniques.* Twenty-six states rely on wetland acquisition, including purchase and conservation easements, to protect wetlands. Twenty-five states have begun to restore and enhance existing wetlands or actually to create new wetlands.

*Research and Assessment.* All but two states have developed inventories and maps of estuaries and wetlands to show wetland boundaries, regulatory jurisdictions and ownership patterns. Such information is useful in state regulatory programs and wetland mitigation and restoration efforts.
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***Hazard Reduction and Beach, Dune, Bluff and Rocky Shores Protection*** (from Bernd-Cohen and Gordon, 1997)

Photo 8. Many coastal states attempt to reduce property damage by requiring structures to be set back from the shoreline.

Long-term erosion and the destructive forces of hurricanes, tsunamis and earthquakes pose significant hazards to coastal residents and visitors. To counter the forces of winds and waves, people often turn to seawalls, bulkheads and other "hard" erosion control structures that simply fail or just move the problem to another part of the beach. States use a broad array of approaches in an effort to prevent such outcomes and to protect valuable shoreline resources effectively.

*Regulation.* Twenty-seven states limit construction on or near highly dynamic beaches, dunes and eroding bluffs through the use of setback provisions. In eight of these states, the setbacks reflect the expected erosion rate of particular beach segments. All states but one regulate the construction of new shoreline stabilization structures. Six states prohibit new stabilization structures on the rationale that such structures are usually ineffective. Most states have also enacted vehicle access prohibitions on beaches and dunes.

*Planning.* Twenty-five states rely on either state or local planning to mitigate the adverse effects of development near dynamic beaches and eroding bluffs. With the assistance of the federal government, states have also developed sophisticated hurricane evacuation plans that identify those areas subject to storm damage, appropriate evacuation routes and available shelters.

*Land and Water Management Techniques.* All states but one acquire coastal lands for beachfront parks with guided access ways and use conservation easements for beach and dune protection. Reductions in federal and state budgets, combined with increasing costs, now limit the feasibility of this approach, however. Thirteen states have funding restrictions that remove subsidies for private development on dynamic beaches, dunes and bluffs. Nineteen states have used beach renourishment (i.e., the artificial replenishment of the beach with off-shore sand), as a way of managing their beaches, but this is expensive and, in many cases, only temporarily effective. All coastal states focus considerable effort on increasing public awareness of the dangers of building in hazardous shoreline areas.

*Research and Assessment.* More than two-thirds of the states use sophisticated techniques such as aerial photography, beach profiles, shoreline erosion modeling and computerized mapping to measure and assess coastal erosion.

Photo 9. Shoreline stabilization structures such as groins are intended to reduce the erosion of shorelines, but in some cases may exacerbate or shift the problem to another portion of the beach.

(See two related essays elsewhere on this Web site–"Coastal Hazards: Population at Risk" and "Coastal Hazards: Reducing the Threat.")
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***Public Access to the Shoreline*** (from Pogue and Lee, 1997)

Over two-thirds of the nation's coastal property is privately owned. The amount of publicly owned coastal property is not adequate to ensure public access to the shore. Most coastal states with federally approved coastal management programs give special attention to public access issues.


Photo 10. Although most beaches are predominantly state-owned and open to the public, private ownership of adjacent lands can severely restrict public access to the shore.

*Regulation.* Twenty-two coastal states require public access to shore areas as a condition of coastal development permits.

*Planning.* Twenty-eight states use public access management plans with publicly available inventories and maps to monitor existing access sites and identify areas that need improvements.

*Land and Water Management Techniques.* Traditionally, states have used public acquisition of parklands and access ways through either fee-simple acquisition or conservation easements to protect public access to the coastline. Decreasing federal and state budgets have limited the use of this method in recent years. Tax incentives and liability waivers may encourage landowners to provide public access across their land. More than two-thirds of coastal states have published access guides and provide street signs to indicate public access sites.

*Research and Assessment.* Twelve coastal states have focused on legal research into the ownership of coastal lands, streets, and other public rights of way. Such research has resulted in the re-opening of many public accessways after years of neglect. (top)

Photo 11. Acquisition of parks or access ways by government agencies has been a traditional method of ensuring public access to the shore.

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***Coral Reef Protection*** (from Pacific Basin Development Council, 1995)

Coral reefs support a huge recreational diving and tourism industry. In the public's rush to enjoy the reefs, however, boats have anchored directly on the reefs, and divers and snorklers have walked on the coral, touched it, and in certain parts of the world, actually removed corals and other marine life for sale. These events have inflicted severe damage on the coral reefs. Other human disturbances (e.g., ship groundings, sedimentation, increased nutrient loads from land-based stormwater runoff and wastewater discharge) seriously imperil the health and viability of coral reefs.

In the United States, coral reefs occur only in the southernmost states and in the Pacific and Caribbean islands. These include the Florida Keys, the Flower Garden Banks off Texas, and significant island reef systems in Puerto Rico, the U.S. Virgin Islands, Hawaii, American Samoa, Guam, the Northern Mariana Islands and other U.S. possessions in the Pacific Ocean.

Photo 12. Restoring coral reefs such as this one in the Florida Keys is one way to address damage caused by ship groundings and anchorings.

*Regulation.* Three states, three territories and two commonwealths prohibit the removal of coral and other living organisms, and restrict touching coral and anchoring boats in coral reef areas. Some states have designated coral reefs as marine protected areas. Many states have marine patrols that monitor boat traffic, water-based recreation and other activities. The states also have regulatory programs to control polluted runoff that affects coral reefs.

*Planning.* Certain coral reef areas require particular attention because of public overuse or their high natural value. Through "water-use planning and zoning," states may specify the type, amount and duration of activities permissible in various portions of the reef. For example, intensive commercial sport diving activities may be allowed in selected areas, while other areas may be set aside for research. Well established marine protected areas such as the Florida Keys National Marine Sanctuary use these more advanced management measures.

*Land and Water Management Techniques.* Because most coral reefs are located beyond the watchful eyes of resource managers, public education and outreach are essential components of coral reef protection programs. These efforts include signage at marinas and boat docks, brochures and other informative media to educate reef visitors, and partnerships with dive shops and clubs to improve understanding of activities that harm reefs. Another important technique is the installation of mooring buoys that allow boats visiting coral reefs to tie up without having to anchor on or near the reef itself.

*Research and Assessment.* Coral reefs are extremely sensitive to naturally occurring diseases and predation, as well as to chemical and temperature pollution, sedimentation, and excessive or inappropriate human recreational diving. Monitoring of reef health and research into the life cycles of coral have recently made it possible to restore reef areas damaged by ship groundings in the Florida Keys National Marine Sanctuary by transplanting coral onto man-made substrate.
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# REGIONAL CONTRASTS

This section examines the coastal management programs in three states. For summaries of all state coastal management programs, consult the most recent biennial reports to Congress on the administration of the Coastal Zone Management Act (NOAA, 1996, 1994b).

**Oregon** (from Oregon Coastal Management Program, 1997a, and Oregon Department of Land Conservation and Development, 1997b)

Photo 13. Oregon uses a combination of restrictions on the number of visitors, construction of interpretive facilities, and regulations for collecting marine life to manage its rocky shores and tidal pools.

The Oregon coastal zone closely approximates the coastal watershed. It extends from the Columbia River to the California border, and from the seaward limit of state jurisdiction inland to the crest of the coastal mountain range. Thus, the Oregon coastal zone has a coastline of 1,410 miles and an area of approximately five million acres (7,800 square miles). It includes extensive tracts of forest lands, dunes, estuarine areas, and rocky shorelines with spectacular coastal headlands and tidal pools. The coast is relatively sparsely populated, with a 1990 population of 1.1 million (about 130 persons per square mile).

Oregon has focused much of its recent coastal management effort on a range of coastal hazards including shoreline erosion, bluff slumping, earthquakes and tsunamis. A working group representing various coastal interests has developed a comprehensive set of recommendations to improve the coastal management program through better data collection, mapping, policy guidance and public information (Oregon Sea Grant, 1994).

The management of Oregon's ocean and near-shore resources has also received considerable attention. In 1992, the Oregon Ocean Plan set forth management objectives for the territorial sea and adjacent outer continental shelf area. The state then developed more detailed information and policies to improve management of its rocky shore, intertidal areas and ocean waters. The rocky shores strategy identifies various types of shorelines and provides additional policy guidance to protect areas such as coastal tide pools from inappropriate development and overuse by coastal visitors.

The Oregon Coastal Management Program (OCMP), a networked/local coastal program type of program, is an integral part of Oregon's statewide land use program. Under Chapter 197 of the Oregon statutes, the Land Conservation and Development Commission (LCDC) has the authority to adopt goals and guidelines for the development of plans, as well as for all land use decisions. The statewide planning goals adopted by the LCDC cover 19 concerns and, as regulations, have the force and effect of law. Four of the goals address estuarine resources, shorelands, beaches and dunes, and ocean resources.

Forty-one coastal cities and counties have developed land use plans. These plans must comply with statewide goals, must be consistent with state agency and special district concerns, must undergo public review, and must ensure that county and city ordinances are compatible in areas projected for urban expansion. Plans and land use regulations are reviewed and updated periodically.

Other state programs that are part of the OCMP address forestry, agriculture and wetland protection issues that complement the objectives of Chapter 197. State agencies are required to coordinate their programs with local governments and to examine their standards and procedures for consistency with the coastal program goals.
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**North Carolina** (from NOAA, 1978b, and North Carolina Division of Coastal Management, 1997)

Photo 14. Protecting its vast areas of coastal wetlands is one of

North Carolina's coastal area has 20 counties. Large expanses of low-lying coastal plain, including extensive coastal wetlands fronted by long barrier islands that protect productive estuarine areas such as Pamlico Sound, dominate the coastal zone. The resulting shoreline is 3,375 miles long. All of the coast is subject to damage from hurricane surges and winds. Although thousands of vacationers flock to the state's famous Outer Banks in the summer, the year-round population of the entire coastal area is only 710,000.

The two highest priorities of North Carolina's coastal management program are protecting the remaining coastal wetlands and reducing the loss of life and structures caused by hurricanes. A geographic information system of coastal wetlands is assisting numerous local governments in improving their wetland programs; the state itself is also implementing wetland conservation and restoration plans. North Carolina has been a national leader in reducing development and limiting the use of hard structures in beachfront high-hazard areas, and the state is strengthening its policies for responding to hurricane disasters as well.

Photo 15. Known as the Outer Banks, North Carolina's narrow, low-lying fringe of barrier islands is especially vulnerable to damage from winds and flooding from storm surge.

The North Carolina Coastal Management Act establishes the state coastal management program, which includes policies, state and local permits, and local land use plans. The North Carolina Department of Environment and Natural Resources is the lead agency, and its Division of Coastal Management is responsible for program implementation. The 15-member Coastal Resources Commission provides policy direction and approves the development of local land use plans.

The coastal program employs a two-tier approach to manage North Carolina's coastal resources. First, the Division of Coastal Management regulates activities through permit requirements in areas of environmental concern delineated by the state, such as near-shore estuarine waters, saltwater wetlands, beaches, primary dunes, ocean erosion areas, and other fragile natural resource areas. Second, the management of other areas within the coastal zone takes place through a coordinated effort of other state laws, local land use plans and Executive Order 15, which requires state agency actions to be consistent with the local land use plans.

Each county in the coastal area must have a land use plan that outlines permissible land use patterns for the area under its jurisdiction. Towns within the coastal counties have the opportunity to develop and adopt their own plans or be included in the county plan. Each land use plan must be consistent with guidelines adopted by the Coastal Resources Commission and contain statements of local land use objectives, policies, a classification of land within the county or town, and a hazards mitigation and post-hazard plan.
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**Massachusetts** (from NOAA, 1978a, and Massachusetts Executive Office of Environmental Affairs, 1997)

The Massachusetts coastal zone generally includes shorelands between the first coastal road and the Atlantic Ocean, all of Cape Cod, Martha's Vineyard, Nantucket and the Elizabeth Islands. Within this coastal zone are 78 cities and towns with more than 1,500 miles of coastline; 47,000 acres of salt marsh; and 42,000 acres of tidal flats. Approximately 40% of the commonwealth's population, 4.5 million people, live in these communities on less than a quarter of the commonwealth's land area. More than half of

the land development in Massachusetts occurs in the coastal zone, straining the state's ability to maintain adequate coastal recreational opportunities.

One of the highest priorities of the Massachusetts coastal program has been to achieve a balance between development and recreational use of the state's coastal barriers. Massachusetts has recently completed an extensive survey of the long-term erosion rate of all its barrier beaches, an access guide to shorefront recreational areas, and a comprehensive guidebook on managing these areas. The state is also working on a registry of protected beach access ways, improved controls over nonpoint pollution, and a management plan for its ocean resources.

Photo 16. As of 1994, the coastal population density in Massachusetts was nearly 1,200 persons per square mile, making development a major focus of coastal management.

Designed to improve the administration of preexisting commonwealth laws, the Massachusetts Coastal Zone Management Program uses a "network" concept. Several agencies within the Executive Office of Environmental Affairs are responsible for implementing the program, with primary program management responsibilities assigned to the Massachusetts Coastal Zone Management Office. This office brings together a staff of technical specialists in marine sciences, environmental law and policy, and public outreach, along with regional coordinators who serve as liaisons to communities and local organizations.

In the Massachusetts program, 28 policies govern activities in the coastal zone. Nineteen of these are regulatory policies and form the basis for administrative decisions on proposed activities that are likely to affect the coastal zone. The remaining nine policies, although not enforceable, promote improved coastal management. Programs such as the Chapter 91-Public Waterfront Act and Regulations, the Wetlands Conservancy Program, the Wetlands Protection Act and Regulations, and the Water Quality Certification Program make it possible to enforce policies.
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# CASE STUDIES

Individual state coastal management programs address coastal resource management problems in a variety of ways. Following are four examples.

## Coastal Hazards in North Carolina

***The Problem.*** A large part of North Carolina's coastline consists of a string of barrier islands known as the Outer Banks. In some areas, these islands are ribbons of sand only a few hundred feet wide. Although they are a natural buffer, protecting estuaries and the mainland from high waves and the constant pounding of ocean waters, the islands themselves are highly vulnerable to flooding and erosion, especially during storms and hurricanes. Many barrier islands are "rolling over" as the front side erodes and storms wash sand to the back side. Development along the barrier islands has dramatically increased the potential for damage to property and loss of human life as a result of hazardous storms.

Photo 17. To prevent coastal structures from wave action, as shown above, North Carolina requires coastal structures to be set back from the shoreline at a distance related to long-term erosion rates.

***The Solution.*** North Carolina's coastal development regulations require property owners to set their buildings back from eroding shorelines and protective beaches and dunes. The average annual erosion rates, natural site features and the nature of the proposed development determine the construction setback required. The setback is measured from the first line

along which aerial photos show stable natural vegetation on aerial photos or from the point at which a ground survey shows no stable vegetation. New, smaller structures must be set back farthest landward of (1) a distance equal to 30 times the long-term annual erosion rate, (2) the crest of the primary dune, (3) the landward toe of the frontal dune, or (4) 60 feet landward of the vegetation line. Larger structures must be set back a distance 60 times the average annual erosion rate or 120 feet landward of the vegetation line. Where erosion rates exceed 3.5 feet per year, the setback line for larger structures is 30 times the erosion rate plus 105 feet. The law allows single-family residences on preexisting lots not deep enough to meet the erosion setback requirements as long as they are set back at least 60 feet.
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## Wetland Protection in Louisiana

***The Problem.*** Large oil and gas resources lie beneath Louisiana's coastal wetlands. Historically, the oil and gas industry has dredged lengthy access canals and slips through vegetated wetlands for well drilling platforms to reach these resources. These actions have caused a significant loss of wetlands and altered the natural hydrology and salinity of these sites.

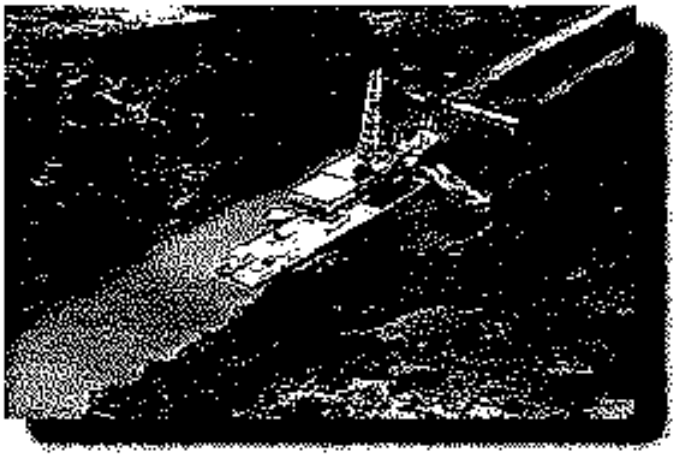

Photo 18. Access canals for oil and gas drilling in Louisiana's coastal wetlands have altered the natural hydrology and salinity of these sites.

***The Solution.*** Louisiana instituted a geologic review process to evaluate industry proposals for less damaging alternatives to the traditional access canals and slips. By using such alternatives as drilling new wells from existing sites, laying removable wooden board roads for access, moving well sites to less damaging locations, and drilling wells at an angle from less damaging locations, the industry has reduced the average area of vegetated wetlands affected per well from 5.2 acres in 1982 to 2.9 acres in 1989 (Good et al., 1997).
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## Public Access in Connecticut

***The Problem.*** Historically, urban development along Connecticut's shoreline has blocked public access to waterfront areas.

***The Solution.*** Under the Connecticut coastal management program,

town planning and permitting responsibilities ensure public access to the shoreline. The program requires towns to conduct a coastal site plan review to determine the potential effects of any development project on coastal resources, public access opportunities and water-dependent uses.

Photo 19. Public access facilities can be a prerequisite for private coastal development in Connecticut.

As a result of the coastal site plan review of the Mystic River Tavern development, for example, the developer was required to provide a section of the Mystic shorefront walkway for public access. When completed and linked together, the walkway will run more than 2.5 miles along the waterfront, linking Route 1 with historic Mystic Village and the Mystic Aquarium. The developer of the tavern built a wooden walkway along the project's entire river frontage. The process of coastal site plan review will ensure that any future development adjacent to this part of the shorefront will include additional sections of the walkway.
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## Coral Reefs in Hawaii

***The Problem.*** It is difficult to overstate the value of coral reef ecosystems to the health and welfare of Hawaii's residents and visitors. Not only do coral reefs protect the coastline from waves and storms, but also they provide recreational activities, generating more than $750 million annually in gross revenues. The coral reef ecosystem is home to fish, lobster and seaweed, which contribute $20 million to the economy, and are a major food source for islanders and tourists. Thirty-four percent of fish and many other animals and plants inhabiting Hawaii's coral reefs appear nowhere else on earth. Large numbers of residents and visitors place stress on these fragile ecosystems. Overfishing, anchor damage and the collection of corals are major threats to the reefs. Other human activities that affect the reefs include sewage disposal, sedimentation, shoreline construction, agricultural practices and deforestation.

***The Solution.*** Hawaii has moved to protect its coral reefs in a variety of ways. The Department of Land and Natural Resources has established seven marine life conservation districts in which taking coral or altering substrate is prohibited. State law makes it unlawful intentionally to take, break or damage any live stony coral from the waters of Hawaii, including live reef or mushroom coral. The sale of eight species of stony corals is also unlawful. Drilling, dredging or blasting in near-shore waters requires a special permit. The Department of Health prohibits the discharge of pollutants into state waters. The Hawaii coastal management and water quality programs have developed a regulatory and nonregulatory polluted runoff control program to protect coastal waters even further. In addition,

125 mooring buoys installed throughout the Hawaiian Islands encourage boaters not to anchor on coral reefs.

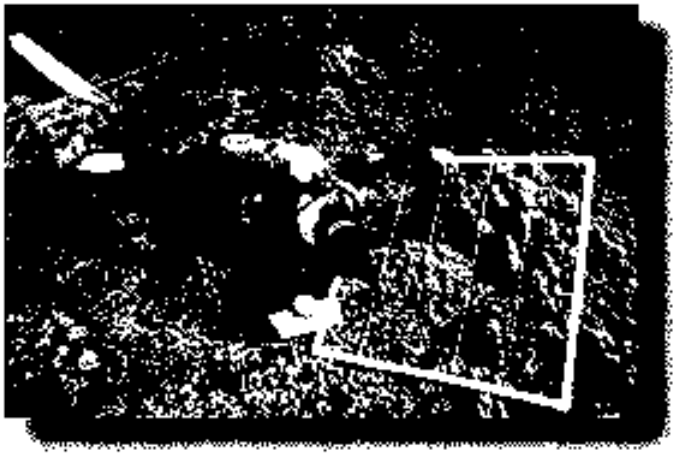

Photo 20. Hawaii manages its coral reefs by prohibiting the taking of coral, regulating polluted coastal runoff, installing mooring buoys to prevent anchor damage, and conducting statewide assessments of reef status and health.

The Hawaii coastal program has supported volunteer efforts under the umbrella of the Hawaii Coral Reef Initiative. As part of this initiative, a diverse group of government agencies, nonprofit organizations, private business and public citizens conducted a statewide assessment of the status and health of Hawaii's coral reefs. Community input has produced a data base that identifies coral reef sites; contains information for evaluating their biological, recreational, cultural and economic importance; and identifies and ranks perceived threats to reef ecosystems. An education and outreach plan includes a calendar of events, a reef display and an activity book for the International Year of the Reef.
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# EXPERT INTERPRETATION

The three individuals below are experts in the topic of Managing Coastal Resources. Here they voice their opinions on two questions relevant to that topic.

**Question 1. What coastal resource management issue or problem poses the greatest challenge to managers today and in the future? Why?**

**Question 2. What approaches or techniques should coastal managers employ to most effectively address the issue or problem, today and in the future, and why? What should the federal and state governments do to support these actions?**

**Experts**

|  |  |  |
|---|---|---|
| **Sarah Cooksey** | **Tim Eichenberg** | **Michael Orbach** |

Sarah Cooksey

Administrator, Delaware Coastal Management Program, Delaware Department of Natural Resources and Environmental Control

Ms. Cooksey has been involved in environmental protection for the past 15 years. For the past five years she has been head of the Delaware Coastal Managment Program; for the past two years, manager of the Delaware National Estuarine Research Reserve. Prior to that, she was employed by the U.S. Environmental Protection Agency in Washington, DC, where she worked with state governments on water pollution control.

Response to Question 1

Response to Question 2

**Question 1. What coastal resource management issue or problem poses the greatest challenge to managers today and in the future? Why?**

Click here for audio response

The greatest management issue that first comes to mind is managing the secondary and cumulative impacts of development in coastal areas. People understand the initial environmental impacts that occur when a shopping center, sewage discharge, housing development, pier or dock, or highway is built, but they do not understand that these projects have lasting detrimental impacts to the coastal environment. Sewage systems might clean up an area contaminated by nutrients from failing septic systems, but they allow more houses and development to occur because wastewater treatment capacity has increased. The edges of our coastal bays are dotted with private piers and docks. If there were only a few of these, the impacts would be minor. Unfortunately, the number of permits issued for these small structures is very high, and every waterfront landowner wants one. If we proceed on this course, a dashed line representing docks and piers will surround the bays. However, we do not have the science that demonstrates that all of these small structures are having a deleterious impact; we just know it, based upon experience, and we cannot develop good policy based upon gut feelings. We need good tools to measure secondary and cumulative impacts.

In the near future, I think we are going to be dealing with the impacts of human population growth in coastal areas. The problems are going to be the same, just bigger.
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**Question 2. What approaches or techniques should coastal managers employ to most effectively address the issue or problem, today and in the future, and why? What should the federal and state governments do to support these actions?**

Click here for audio response

We must have good science to make good policy decisions, and the science is expensive. More and more we have to prove, beyond a shadow of a doubt for some groups, that what they are doing is causing an impact. It is very expensive and time-consuming, but private property rights seem to be in charge, and very powerful, and resistant to change. It would be nice if we could be assured that people would do the right thing without being regulated. If people would do things voluntarily, we wouldn't need regulation. The federal government can help us with consensus-building tools and share with states what other coastal resource managers have done to successfully avoid or mitigate impacts.
(top)

Tim Eichenberg

Program Counsel, Center for Marine Conservation

Tim Eichenberg has been Program Counsel for the Center for Marine Conservation in Washington, DC since 1992. From 1989 to 1992, he lectured in environmental and coastal law at the University of Maine School of Law and was co-editor of the *Territorial Sea Journal* . He was a Post-Doctoral Marine Policy Fellow at the Woods Hole Oceanographic Institution from 1985-87 and Staff Counsel for the California Coastal Commission from 1980-85.

Response to Question 1

Response to Question 2

**Question 1. What coastal resource management issue or problem poses the greatest challenge to managers today and in the future? Why?**

Click here for audio response

The most serious problem afflicting coastal water quality today comes from the land. Polluted runoff, also called "nonpoint source pollution" by resource managers, is the primary reason why, 25 years after the enactment of the Clean Water Act, nearly 40% of the nation's assessed waterways are still not fishable or swimmable. The Act has made remarkable progress reducing "point source" discharges from factories and sewage treatment plants through an enforceable permit program using national technology standards and effluent controls.

But a vastly different approach was attempted in dealing with polluted runoff, stressing voluntary management measures and state water quality standards. Unfortunately, these strategies have proven largely unsuccessful in dealing with the more diffuse and ubiquitous sources of polluted runoff. This is especially true of the leading cause of water quality impairment, agriculture, which chokes waterways with toxic chemicals and harmful algae blooms from excess nutrients, sediments, pesticides and fertilizers. Voluntary measures have also proven ineffective in addressing polluted runoff from parking lots, roads, lawns and golf courses, logging and mining operations, construction activities, and leaking septic and sanitary sewer systems. Ultimately, pollutants from these activities flow into the coastal zone, where they pose significant human health, economic and environmental problems. As we celebrate the 25th Anniversary of the Clean Water Act in 1997, we must look for a new and more effective approach to deal with the ubiquitous causes of polluted runoff.
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**Question 2. What approaches or techniques should coastal managers employ to most effectively address the issue or problem, today and in the future, and why? What should the federal and state governments do to support these actions?**

Click here for audio response

Since the enactment of the Clean Water Act 25 years ago, the major cause of water pollution and habitat degradation has shifted from "point sources" (sewage and industrial discharges) to "nonpoint sources" (polluted runoff from roads, farming, grazing, urban development, logging, mining and other land uses). Many of these local activities require local approaches to reduce pollution, but there is also a need for a strong national program to provide guidance, funding, incentives and accountability to state and local governments. Unfortunately, the federal programs created to address polluted runoff are not up to the job.

The national nonpoint source pollution program, created under the 1987 amendments to the Clean Water Act (the section 319 program), lacks "teeth." States prepare nonpoint source pollution plans, but are not required to implement or enforce measures to reduce polluted runoff. In contrast, a national program was created in 1990 to ensure that additional actions to control polluted

runoff are implemented in coastal areas if voluntary measures are ineffective.

Twenty-nine states and territories have submitted coastal nonpoint pollution plans to NOAA and EPA. However, not one has received final, unconditional approval, and no money has been appropriated to implement the program since 1995. Funds provided under the 1996 Farm Bill to reduce pollution from agricultural sources lack accountability and focus. To help restore our nation's water quality on the occasion of the 25th Anniversary of the Clean Water Act, Congress must strengthen the law to ensure that states implement enforceable polluted runoff controls within reasonable time frames, and adequately fund the development and implementation of meaningful programs to reduce polluted runoff. Without accountability, relying upon voluntary measures to reduce pollution is like relying upon drivers to obey traffic signals without speed limits, radar guns, driver's licenses or traffic cops.
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Michael Orbach

Professor of Marine Affairs and Policy and Director, Coastal Environmental Management Program Marine Laboratory, Nicholas School of the Environment, Duke University

Dr. Orbach has been affiliated with the Duke University Marine Laboratory since 1993. Previously, he held academic and governmental positions on the East and West Coast since 1976. He has performed research and been involved in coastal and marine policy on all coasts of the U.S. and in Mexico, Central America, the Caribbean and the Pacific, and has published widely on social science and policy in coastal and marine environments.

**Question 1. What coastal resource management issue or problem poses the greatest challenge to managers today and in the future? Why?**

Click here for audio response

We must "design" the coast, from the inland boundaries of the watersheds to at least the first 200 miles of the coastal ocean. Human activities are shaping the coastal environment, but not in a way that has been thought out beforehand. The two greatest demographic movements in the world today are the movement from rural to urban areas and the movement from inland areas to the coast. Coastal development and recreation, fishing, shipping, aquaculture, military uses, even parks and sanctuaries&endash;all of these things shape the coastal environment. We must begin to comprehensively plan the shape of the coastal environment, rather than allow that shape to develop haphazardly.

Many people object to the notion of "shaping" a "natural" environment. I do not mean that we humans can improve upon nature. I mean that the increasing density and intensity of our activities are shaping the environment in a *de facto* way; very few, if any portions of the coastal&endash;or any other&endash;environment are pristine or completely "natural." Perhaps a pristine nature is one kind of objective for human planning; I suspect it is not a very realistic one for most of our coastal environments. Most of our coastal environments will be significantly shaped by the effects of human behavior; the only question is our inclination and ability to determine that shape.
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**Question 2. What approaches or techniques should coastal managers employ to most effectively address the issue or problem, today and in the future, and why? What should the federal and state governments do to support these actions?**

Click here for audio response

We must move fields such as landscape ecology from a passive, academic orientation to a proactive, unified governance orientation from the inland limits of the coastal watersheds to at least 200 miles offshore. We must use tools such as remote sensing, geographic information system technology, and citizen monitoring to more adequately display the state of&endash;and the possibilities for&endash;the shape of our coastal environments. We must drop the false and insupportable notion that humans are not part of the "natural" environment. We

must realize that humans, with our capacity to profoundly affect, if not control, the non-human portion of the environment, are a part of the natural landscape. We must find forums more adequate than "public hearings" for the involvement of "the public" in governance decisions. We must trust in the ultimate good judgment of the public, not the supposed enlightened judgment of scientists, administrators or educators, for the governance decisions that will shape coastal environments. Information may be supplied by scientists, and processed and conveyed by administrators and educators, but the ultimate governance decisions must be made by the public, and yes, politicians. For better or worse, politicians are the legitimate conduits for the will of the people. No scientific finding or educational process can change that fact. Human governance systems, like the non-human environment itself, are extremely adaptable, and we should use that adaptability to fashion a symbiosis between humans and non-human coastal environments, a symbiosis that will lead to a sustainable future for the coast.

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Provides a description of the mission of NOAA and its state partners in administering the coastal zone management program as directed in the Coastal Zone Management Act of 1972; includes a synopsis of the Act with information on the coastal nonpoint pollution control program, the coastal zone enhancement program and federal consistency in the program.

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Office of Ocean and Coastal Resource Management. State and Territory Coastal Management Program Summaries.

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Office of Ocean and Coastal Resource Management. State and Territory Coastal Management Program Home Pages.

http://www.nos.noaa.gov/ocrm/czm/czmpages.html

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## Legislation

Office of Ocean and Coastal Resource Management. Coastal Zone Management Act of 1972.

http://wave.nos.noaa.gov/ocrm/czm/CZM_ACT.html

Contains the complete text of the Coastal Zone Management Act of 1972, as amended through 1995.

## Coastal Resource Management Information and Newsletters

Coastal States Organization

http://www.sso.org/cso/

Contains list of contacts for state, territory and commonwealth coastal management programs, as well as positions taken by the Coastal States Organization on public policy issues of importance to coastal states.

Dutch Coastal Zone Management Center. NetCoast: A Guide to Integrated Coastal Zone Management.

http://www.minvenw.nl/projects/netcoast/index.html

Provides general information from around the world on views, issues and experience relating to international coastal zone management; includes information on the physical, social and economic characteristics of coastal zones and on conditions constraining their management.

NOAA's Coastal Services Center

http://www.csc.noaa.gov/

Describes some of the products associated with the more than 100 projects conducted annually by the Center and its project partners, as well as its primary programs. Examples of products are the Coastal Information Directory, an Internet-based searching tool for sources of coast-related data, and the Columbia River Change Detection CD-ROM, a tool to help fisheries managers assess how landscape change affects salmon habitat. Examples of programs are the Coastal Change Analysis Program and Landscape Characterization and Restoration Program. The site also contains an extensive annotated index of coastal management Web sites.

U.S. Agency for International Development. Learning from Experience: Progress in Integrated Coastal Management.

http://brooktrout.gso.uri.edu/csdtoc.html

Provides an in-depth review of integrated coastal management, including 10 strategies for successful integrated coastal management and eight integrated coastal management international case studies.

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University of Rhode Island Coastal Resources Center. Intercoast Network.

http://brooktrout.gso.uri.edu/IC_main_page.html

Contains nine issues of an international newsletter on coastal management. Numerous articles provide information, experience and ideas on coastal management.

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Urban Harbors Institute. Coastlines.

http://www.epa.gov/OWOW/estuaries/coastlines/

Contains informative articles on a diverse array of coastal resources management issues. Emphasis is on management of estuaries and near coastal waters.

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# APPENDICES

Appendix A. Selected Coastal Resources and Management Issues of National Interest

Appendix B. Area and Shoreline Length Statistics for States with Federally Approved Coastal Management Programs

Appendix C. Select Management Issues Important to Coastal States

Appendix D. Select Management Issues of Importance to Coastal States (Map)

Appendix E. Coastal Management Program Type by State

Appendix F. Examples of Processes and Techniques Used in State CZM Programs to Protect Wetland Habitats

Appendix G. Examples of Processes and Techniques Used in State CZM Programs to Protect Coastal Areas from Hazards and Beach, Dune, and Rocky Shores Protection

Appendix H. Examples of Processes and Techniques Used in State CZM Programs to Provide for Public Access

# Appendix A

The following summaries highlight the status of key resources and the need for management.

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## Selected Coastal Resources and Management Issues of National Interest

Section 303 of the Coastal Zone Management Act declares that it is national policy to encourage states to develop and implement management programs to achieve wise use of the land and water resources of the coastal zone. It also specifies that these programs should include provisions for the use of certain resources of the coastal zone. Some of those resources and the need for their management are discussed below. In addition, there is a national interest in coastal-dependent resource use and major facilities related to national defense, energy, fisheries development, recreation, ports and transportation; redevelopment of deteriorating urban waterfronts and ports; and preservation and restoration of historic, cultural and esthetic coastal features.

### Coastal Wetlands

Coastal wetlands (both tidal and nontidal) are among the most productive areas on earth. They are essential habitat for the spawning, feeding and growth of a majority of the nation's living marine resources (Chambers, 1991). At the same time, they are among the most stressed natural ecosystems. Since 1780, nearly half of all coastal wetlands, excluding those in Alaska, have disappeared through draining, diking, filling, excavating and other alterations for agriculture, port and urban expansion, and recreational uses such as marinas (Dahl, 1990). Stresses on the remaining coastal wetlands are the result of pollutants from nonpoint sources such as farms, forest harvest activities, construction sites and urban areas. Today, nontidal wetlands in the coastal zone are most at risk from development pressures brought about by rapid coastal population growth and the demands for housing, transportation, and commercial and recreational facilities (Good et al., 1997). A future topic essay for NOAA's State of the Coast Report will address the status of essential fish habitats, including coastal wetlands.
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### Coral Reefs

In regard to the nearly 16,000 square kilometers of coral reefs in U.S. coastal waters, two points are clear. First, coral reefs are vulnerable to damage whenever they are close to large concentrations of people; second, while there is widespread agreement that coral reefs are in decline, data are available to evaluate the status and trends of coral reefs at only a few limited sites (Miller and Crosby, 1998). In addition to the carelessness of boaters and divers, many activities on adjacent shorelands and near-shore waters have harmed coral reefs. These problems include increased pollution from industry, polluted runoff from urban areas and farms, and coastal channel dredging that increases the turbidity of coastal waters. A summary of the status of U.S. coral reefs can be found elsewhere in NOAA's State of the Coast Report.
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### Beaches, Dunes, Bluffs, and Rocky Shores and Coastal Hazards

Beaches and dunes provide habitat for plants and wildlife, as well as protection for inland natural coastal features

and man-made structures. Beaches are also important for coastal recreation. Many states are experiencing significant loss of beaches and bluffs as a result of constant wave action. Severe storms, rising sea level and man-made shoreline "stabilization" structures often accelerate this gradual, long-term erosion (1 to 3 feet per year) (Kaufman and Pilkey, 1983). Increasing beach use often brings damage, sometimes severe, to sand dunes and rocky shores habitat. Chronic or episodic erosion, as well as the forces of high winds, waves and coastal flooding, pose significant hazards to coastal residents, visitors and property. The only nationwide survey of shoreline erosion, published in 1971, shows that 7% of the nation's coastline is eroding at a rate where properties are in imminent danger of collapse; 25% is experiencing significant erosion. Most of the 400 barrier islands along the East Coast and Gulf of Mexico are losing 1 to 10 feet per year (U.S. Army Corps of Engineers, 1971).
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## Public Access to the Shoreline

More than 139 million people–about 53% of the national total–reside in coastal areas. This number is expected to increase by an average of 3,600 people per day, reaching 165 million by the year 2015 (Culliton, 1998). Annually, about 180 million people visit the coast for recreational purposes (Cunningham and Walker, 1996). Access to the shoreline is critical to the public's use and enjoyment of the many varied coastal resources. In the last survey of shoreline ownership, conducted in 1972, about two-thirds of the nation's shoreline property was privately owned; about 20% was publicly owned by federal, state and local governments; and the remainder was of undetermined ownership (Pogue and Lee, 1997). In most states, ocean beaches below the ordinary high tide line are public lands. However, the right to cross private property to get to the public beach often is not guaranteed. Recent court decisions on this issue have favored private property rights and restricted public access *(Nolan v. California Coastal Commission, Dolan v. City of Tigard).*

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# Appendix B

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## Area and Shoreline Length Statistics for States with Federally Approved Coastal Management Programs (NOAA, 1975; Farrow et al., 1992; Bureau of the Census, 1994)

| State/Territory/ Commonwealth | Year Approved | Shoreline Length (miles) | Area within CZ (sq. miles) | Total Area (sq. miles) | % of Area within CZ |
|---|---|---|---|---|---|
| **Pacific Region** | | | | | |
| Washington | 1976 | 3,026 | 18,900 | 66,581 | 28% |
| Oregon | 1977 | 1,410 | 8,400 | 96,003 | 9% |
| California | 1977 | 3,427 | 2,800 | 155,973 | 2% |
| Hawaii | 1978 | 1,052 | 6,425 | 6,423 | 100% |
| Alaska | 1979 | 33,904 | -- | 570,374 | -- |
| Guam | 1979 | 110 | 212 | 212 | 100% |
| American Samoa | 1980 | 126 | 76 | 76 | 100% |
| Northern Mariana Islands | 1980 | 206 | 181 | 181 | 100% |
| **Gulf of Mexico** | | | | | |
| Puerto Rico | 1978 | 700 | 434 | 3,459 | 13% |
| Alabama | 1979 | 607 | 500 | 50,750 | 1% |
| Virgin Islands | 1979 | 175 | 135 | 135 | 100% |
| Louisiana | 1980 | 7,721 | 7,300 | 43,566 | 17% |
| Mississippi | 1980 | 359 | 1,800 | 46,914 | 4% |
| Florida | 1981 | 8,436 | 53,937 | 53,937 | 100% |
| Texas | 1997 | 3,359 | 5,292 | 261,914 | 2% |
| **Southeast** | | | | | |
| North Carolina | 1978 | 3,375 | 9,400 | 48,718 | 19% |
| Maryland | 1978 | 3,190 | 6,400 | 9,775 | 65% |
| South Carolina | 1979 | 2,876 | 7,800 | 30,111 | 26% |
| Delaware | 1979 | 381 | 1,932 | 1,955 | 99% |
| Virginia | 1986 | 3,315 | 8,700 | 39,598 | 22% |
| Georgia | 1998 | 2,344 | 5,638 | 57,919 | 10% |
| **Northeast** | | | | | |
| New Jersey | 1980 | 1,792 | 1,200 | 7,419 | 16% |
| Rhode Island | 1978 | 384 | 500 | 1,045 | 48% |
| Massachusetts | 1978 | 1,519 | 1,000 | 7,838 | 13% |
| Maine | 1978 | 3,478 | 3,700 | 30,865 | 12% |
| Connecticut | 1980 | 618 | 900 | 4,845 | 19% |
| New York | 1982 | 2,625 | 3,600 | 47,224 | 8% |
| New Hampshire | 1982 | 131 | 100 | 8,969 | 1% |
| **Great Lakes** | | | | | |
| Michigan | 1978 | 3,224 | 2,900 | 56,809 | 5% |
| Wisconsin | 1978 | 820 | 10,700 | 54,314 | 20% |
| Pennsylvania | 1980 | 140 | 200 | 44,820 | <1% |
| Ohio | 1997 | 312 | -- | 40,953 | 0% |
| Indiana | U/D | 45 | -- | 35,870 | -- |
| Minnesota | U/D | 189 | -- | 79,617 | -- |
| Illinois | N/P | 63 | -- | 55,593 | -- |
| **Total** | **35** | **95,439** | **171,062** | **2,020,755** | **8%** |

Abbreviations: CZ, coastal zone; U/D, under development; N/P, not participating; --, not available at this time.

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# Appendix C

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## Select Management Issues Important to Coastal States*

| State/Territory/ Commonwelath | Management Issue: Wet-lands | Coral Reefs | Coastal Hazards | Public Access |
|---|---|---|---|---|
| **Pacific Region** | | | | |
| Washington | ✓ | | ✓ | ✓ |
| Oregon | | | ✓ | |
| California | ✓ | | ✓ | ✓ |
| Hawaii | | ✓ | ✓ | ✓ |
| Alaska | ✓ | | ✓ | |
| Guam | | ✓ | ✓ | |
| American Samoa | ✓ | ✓ | ✓ | |
| Northern Mariana Islands | ✓ | ✓ | ✓ | |
| **Gulf of Mexico** | | | | |
| Puerto Rico | ✓ | ✓ | | |
| Alabama | ✓ | | ✓ | ✓ |
| Virgin Islands | ✓ | ✓ | | ✓ |
| Louisiana | ✓ | | ✓ | |
| Mississippi | ✓ | | ✓ | ✓ |
| Florida | ✓ | ✓ | ✓ | ✓ |
| Texas | ✓ | ✓ | ✓ | |
| **Southeast** | | | | |
| North Carolina | ✓ | | ✓ | |
| Maryland | ✓ | | ✓ | ✓ |
| South Carolina | ✓ | | ✓ | ✓ |
| Delaware | ✓ | | | |
| Virginia | | | | ✓ |
| Georgia | ✓ | | ✓ | |
| **Northeast** | | | | |
| New Jersey | | | ✓ | |
| Rhode Island | ✓ | | | |
| Massachusetts | | | | ✓ |
| Maine | ✓ | | | |
| Connecticut | ✓ | | | ✓ |
| New York | | | | ✓ |
| New Hampshire | ✓ | | | |
| **Great Lakes** | | | | |
| Michigan | ✓ | | ✓ | ✓ |
| Wisconsin | ✓ | | ✓ | |
| Pennsylvania | ✓ | | ✓ | |
| Ohio | | | ✓ | |
| **# of States** | **24** | **8** | **22** | **14** |
| **% of States** | **75%** | **26%** | **69%** | **45%** |

* Priority management issues were determined by projects and activities funded under Section 309, program enhancement grants, during the past 10 years under the Coastal Zone Management Act. For Texas, Ohio and Georgia, priority management issues were determined by reviewing each state's description of its coastal management program. Absence of a check mark does not necessarily mean that an issue is unimportant to a state.

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# Appendix D

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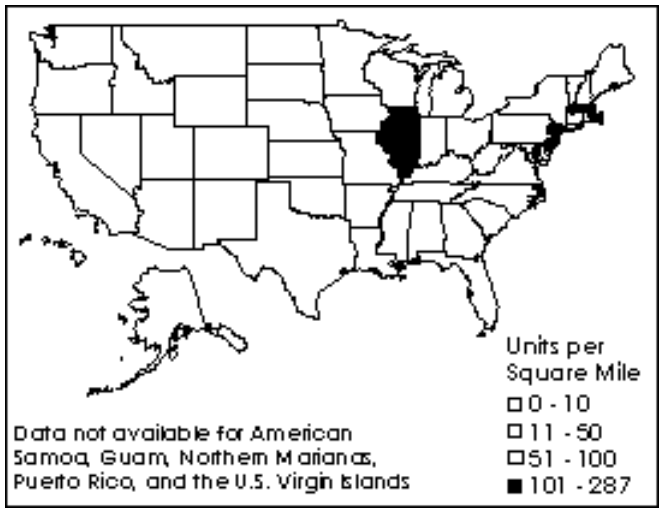
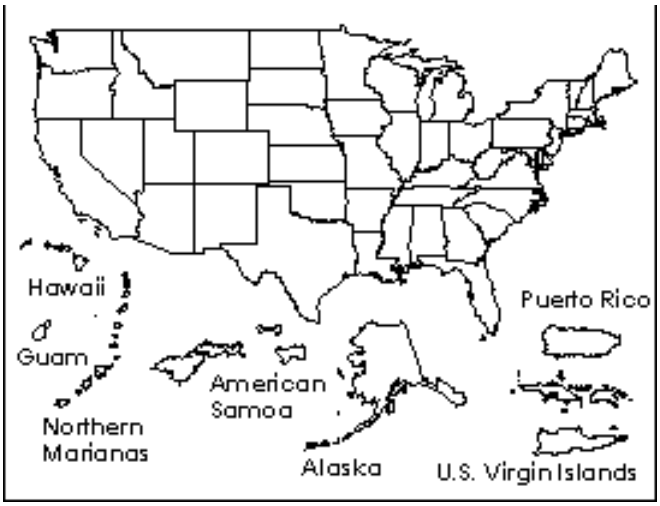
**Relative Importance of Select Management Issues by State, Territory and Commonwealth***

**New Coastal Housing Units per Square Mile; 1970-89**
**Indicates Relative Importance of Coastal Development Issues**



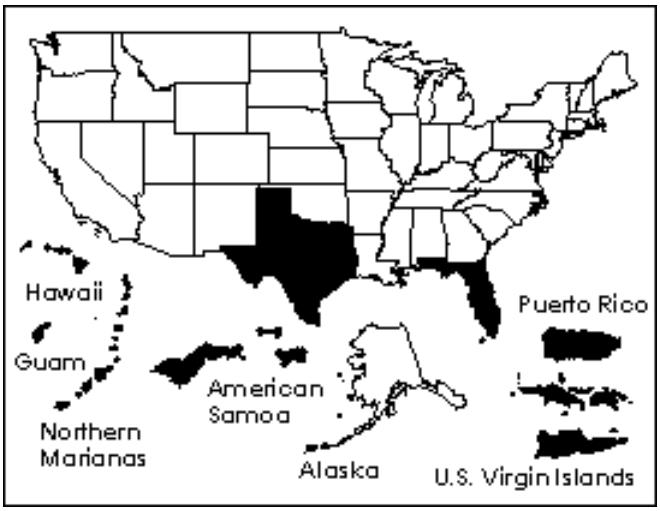

**Coastal Hazards as an Issue of Coastal Management Importance**


**Public Access as an Issue of Coastal Management Importance**




**Coastal Wetlands as an Issue of Coastal Management Importance**


**Coral Reefs as an Issue of Coastal Management Importance**




* Priority management issues were determined by projects and activities funded under Section 309, program enhancement grants, over the past 10 years under the Coastal Zone Management Act. For Texas, Ohio, and Georgia, priority management issues were determined based on review of each state's description of its coastal management program. Except for the issue of coral reefs, the absence of highlighting a state, territory or commonwealth does not necessarily mean that the issue is unimportant to a state.
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# Appendix E

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## Coastal Zone Management Program Type by State (NOAA, 1997a)

| State/Territory/ Commonwealth | Program Type* | Comprehensive Coastal Legislation** |
|---|---|---|
| **Pacific Region** | | |
| Washington | Networked/LCP* | |
| Oregon | Networked/LCP | |
| California | Direct/LCP | Y |
| Hawaii | Networked/LCP | Y |
| Alaska | Networked/LCP | Y |
| Guam | Networked | |
| American Samoa | Networked | Y |
| Northern Mariana Islands | Direct | Y |
| **Gulf of Mexico** | | |
| Puerto Rico | Networked | |
| Alabama | Networked | Y |
| Virgin Islands | Direct | Y |
| Louisiana | Direct/LCP | Y |
| Mississippi | Networked/Regulatory | |
| Florida | Networked | |
| Texas | Networked/LCP | Y |
| **Southeast** | | |
| North Carolina | Direct/LCP | Y |
| Maryland | Networked | |
| South Carolina | Direct | Y |
| Delaware | Networked/Regulatory | Y |
| Virginia | Networked | |
| Georgia | Networked/Regulatory | |
| **Northeast** | | |
| New Jersey | Direct | |
| Rhode Island | Direct | Y |
| Massachusetts | Networked | |
| Maine | Networked | |
| Connecticut | Direct | Y |
| New York | Networked/LCP | Y |
| New Hampshire | Networked | |
| **Great Lakes** | | |
| Michigan | Networked/Regulatory | |
| Wisconsin | Networked | |
| Pennsylvania | Networked | |
| Ohio | Networked/LCP | Y |

Abbreviation: Y = yes
*See discussion of state coastal zone management structure in the National Picture section for an explanation of program types.
**Legislation covering the full range of uses and resources subject to coastal management. States without comprehensive coastal legislation rely on single-purpose laws (e.g., state wetlands or beach management laws and/or statewide land-use planning statutes) to enable them to manage coastal resources.

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# Appendix F

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## Examples of Processes and Techniques Used in State CZM Programs to Protect Wetland Habitats* (Good et al., 1997)

| | Regulatory | | | | Planning | | Land and Water Management | | Research and Assessment | |
|---|---|---|---|---|---|---|---|---|---|---|
| State/Territory/ Commonwealth | Wetland Permits | Compensatory Mitigation | Setbacks or Buffers | Mitigation Banking | Local Land-use Plans | Special Area Management Plans | Land Acquisition | Resotoration and Enhancement | Inventory and Mapping | Resource Assessment |
| **Pacific** | | | | | | | | | | |
| Washington | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| Oregon | √ | √ | √ | √ | √ | | | | √ | √ |
| California | √ | √ | √ | √ | √ | √ | √ | √ | | √ |
| Hawaii | √ | √ | | | √ | √ | √ | √ | | √ |
| Alaska | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| Guam | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| American Samoa | √ | √ | √ | | √ | √ | √ | √ | | √ |
| Northern Mariana Islands | √ | √ | √ | | | √ | | | √ | |
| **Gulf of Mexico** | | | | | | | | | | |
| Puerto Rico | √ | √ | √ | √ | √ | √ | √ | √ | √ | |
| Alabama | √ | √ | | | √ | | √ | | √ | √ |
| Virgin Islands | √ | √ | | | √ | | | | | |
| Louisiana | √ | √ | | √ | √ | √ | √ | √ | √ | √ |
| Mississippi | √ | √ | √ | √ | √ | √ | | | √ | √ |
| Florida | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Texas | √ | √ | | | | | √ | | √ | √ |
| **Southeast** | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| North Carolina | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| Maryland | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| South Carolina | √ | √ | √ | | √ | √ | √ | √ | √ | |
| Delaware | √ | | √ | | √ | √ | √ | √ | √ | √ |
| Virginia | √ | √ | | √ | √ | √ | √ | √ | √ | √ |
| Georgia | √ | | √ | | √ | | √ | √ | √ | √ |
| **Northeast** | | | | | | | | | | |
| New Jersey | √ | √ | √ | √ | √ | √ | √ | | √ | √ |
| Rhode Island | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| Massachusetts | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| Maine | √ | √ | √ | √ | √ | | √ | | √ | √ |
| Connecticut | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| New York | √ | √ | √ | √ | √ | √ | √ | | √ | √ |
| New Hampshire | √ | √ | √ | | √ | | √ | √ | √ | √ |
| **Great Lakes** | | | | | | | | | | |
| Michigan | √ | √ | √ | √ | √ | | √ | √ | √ | √ |
| Wisconsin | √ | | √ | | √ | | √ | √ | √ | √ |
| Pennsylvania | √ | √ | | | | | | | √ | √ |
| Ohio | √ | √ | | | | √ | √ | | | √ |
| **Number of States** | **32** | **29** | **24** | **13** | **28** | **21** | **27** | **21** | **30** | **28** |
| **Percentage of States** | **100%** | **91%** | **75%** | **41%** | **88%** | **66%** | **84%** | **66%** | **94%** | **88%** |

*A wide variety of processes and tools are used by each state. These represent some of the most important ones based on interviews with state CZM staff (Good et al., 1997).

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# Appendix G

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## Examples of Processes and Techniques Used in State CZM Programs to Protect Coastal Areas from Hazards and Beach, Dune and Rocky Shores Protection* (Bernd-Cohen and Gordon, 1997)

| | Regulatory | | Planning | | Land and Water Management | | | | | Research and Assessment | | Education |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| State/Territory/ Commonwealth | Setbacks | Shoreline Stabilization Restrictions | Local Land-use Plans | Special Area Management Plans | Public Investment Restrictions | Coastal Property Disclosure | Land Acquisition | Dune Restoration | Beach Renourishment | Beach Profile Development | Inventory and Mapping | Publications, Workshops, and Conferences |
| **Pacific** | | | | | | | | | | | | |
| Washington | √ | √ | √ | | | | √ | | | | √ | √ |
| Oregon | √ | √ | √ | | | √ | √ | | √ | √ | √ | √ |
| California | √ | √ | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| Hawaii | √ | √ | √ | √ | | | √ | | | √ | √ | √ |
| Alaska | | | √ | √ | | | | | | | √ | √ |
| Guam | √ | √ | √ | √ | | | √ | | | √ | √ | √ |
| American Samoa | √ | √ | | | | | | | | | √ | √ |
| Northern Mariana Islands | √ | √ | | √ | | | | | | √ | √ | √ |
| **Gulf of Mexico** | | | | | | | | | | | | |
| Puerto Rico | √ | √ | | √ | √ | | √ | | | √ | √ | √ |
| Alabama | √ | √ | √ | | | | | √ | | √ | √ | √ |
| Virgin Islands | √ | √ | | √ | √ | | | | | | √ | √ |
| Louisiana | | √ | √ | | | √ | | √ | √ | √ | | √ |
| Mississippi | | √ | √ | | | √ | | | √ | √ | √ | √ |
| Florida | √ | √ | √ | | √ | √ | √ | √ | √ | √ | √ | √ |
| Texas | √ | √ | √ | | | | | √ | √ | √ | √ | √ |
| **Southeast** | | | | | | | | | | | | |
| North Carolina | √ | √ | √ | | √ | | √ | √ | √ | √ | √ | √ |
| Maryland | √ | √ | √ | | √ | √ | √ | √ | √ | √ | √ | √ |
| South Carolina | √ | √ | √ | | | √ | √ | √ | √ | √ | √ | √ |
| Delaware | √ | √ | | | √ | | √ | √ | √ | √ | √ | √ |
| Virginia | √ | √ | √ | √ | | | √ | √ | √ | √ | √ | √ |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Georgia | √ | √ | √ | | | | | √ | √ | | | √ |
| **Northeast** | | | | | | | | | | | | |
| New Jersey | √ | √ | √ | | | | | | √ | √ | √ | √ |
| Rhode Island | √ | √ | | √ | √ | | √ | | | √ | √ | √ |
| Massachusetts | | √ | √ | √ | √ | | √ | √ | √ | | √ | √ |
| Maine | √ | √ | √ | √ | √ | | √ | √ | √ | √ | √ | √ |
| Connecticut | | √ | √ | | √ | | √ | √ | √ | √ | √ | √ |
| New York | √ | √ | √ | | √ | | √ | | √ | √ | √ | √ |
| New Hampshire | √ | √ | √ | | | | √ | √ | √ | √ | √ | √ |
| **Great Lakes** | | | | | | | | | | | | |
| Michigan | √ | √ | √ | | √ | | √ | | | √ | √ | √ |
| Wisconsin | √ | √ | √ | √ | | | √ | | | √ | √ | √ |
| Pennsylvania | √ | √ | | | | | √ | | √ | | | √ |
| Ohio | √ | √ | √ | | | | | | | √ | √ | √ |
| **Number of States** | **27** | **31** | **25** | **12** | **13** | **6** | **21** | **15** | **19** | **25** | **29** | **32** |
| **Percentage of States** | **84%** | **97%** | **78%** | **38%** | **41%** | **19%** | **66%** | **47%** | **59%** | **78%** | **91%** | **100%** |

A wide variety of processes and techniques are used by each state. These represent some of the most important ones based on interviews and surveys with state CZM staff (Bernd-Cohen and Gordon, 1997).

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# Appendix H

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## Examples of Processes and Techniques Used in State CZM Programs to Provide Public Access* (Pogue and Lee, 1997)

| State/ Territory/ Commonwealth | Regulatory | | Planning | Land and Water Management | | | Research and Assessment | |
|---|---|---|---|---|---|---|---|---|
| | Permit Conditions | Liability Waivers | Public Access Mgt. Plans | Acquisition and Conservation Easements | Signage Programs | Access Guides | Legal Research on Property Ownership | Inventory and Mapping |
| **Pacific** | | | | | | | | |
| Washington | √ | √ | √ | √ | √ | √ | √ | √ |
| Oregon | | | √ | √ | √ | √ | | √ |
| California | √ | √ | √ | √ | √ | √ | √ | √ |
| Hawaii | √ | √ | √ | √ | √ | √ | | √ |
| Alaska | | | √ | √ | √ | √ | | √ |
| Guam | √ | | √ | √ | | √ | | √ |
| American Samoa | √ | | | | | √ | | |
| Northern Mariana Islands | √ | | | √ | √ | √ | | √ |
| **Gulf of Mexico** | | | | | | | | |
| Puerto Rico | √ | | √ | √ | | | | |
| Alabama | | √ | √ | √ | √ | √ | √ | √ |
| Virgin Islands | √ | √ | √ | √ | √ | | | |
| Louisiana | | | | √ | √ | | | √ |
| Mississippi | √ | √ | √ | √ | √ | √ | √ | √ |
| Florida | √ | √ | √ | √ | √ | √ | √ | √ |
| Texas | √ | | √ | √ | √ | | √ | √ |
| **Southeast** | | | | | | | | |
| North Carolina | √ | | √ | √ | √ | √ | | √ |
| Maryland | | √ | √ | √ | √ | √ | | √ |
| South Carolina | | | √ | √ | √ | √ | | √ |
| Delaware | √ | | √ | √ | √ | √ | | √ |
| Virginia | √ | √ | √ | √ | √ | √ | | √ |
| Georgia | | | √ | | | | | |
| **Northeast** | | | | | | | | |
| New Jersey | √ | √ | √ | √ | √ | √ | √ | √ |
| Rhode Island | √ | √ | √ | | √ | √ | √ | √ |
| Massachusetts | √ | √ | √ | √ | √ | √ | √ | √ |
| Maine | | | √ | √ | √ | √ | √ | √ |
| Connecticut | √ | √ | √ | √ | √ | √ | | √ |
| New York | √ | √ | √ | √ | | | √ | √ |
| New Hampshire | √ | | | √ | √ | | | √ |
| **Great Lakes** | | | | | | | | |
| Michigan | √ | √ | √ | √ | √ | | | √ |
| Wisconsin | | | √ | √ | √ | √ | | √ |
| Pennsylvania | √ | √ | √ | √ | √ | √ | √ | √ |
| Ohio | | | √ | √ | √ | | | √ |
| **Number of States** | **22** | **16** | **28** | **30** | **27** | **23** | **12** | **28** |
| **Percentage of States** | **71%** | **50%** | **88%** | **94%** | **84%** | **72%** | **38%** | **88%** |

*A wide variety of processes and tools are used by each state. These represent some of the most important ones based on interviews and surveys with state CZM staff (Pogue and Lee, 1997).

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# GLOSSARY

**area of particular concern:** a coastal location that generally requires special management attention because of its economic and/or natural resource value or because of the potential for conflicts among competing uses is so great.

**barrier island:** a low-lying complex of unconsolidated sand formed into a system of beaches, dunes, marshes and tidal flats surrounded by water. The resulting barrier protects coastal embayments and sounds, as well as the mainland shoreline, from the open ocean.

**beach profile:** the measured depth of coastal waters on a line perpendicular to a beachfront shoreline; used to determine the amount and location of near-shore sand deposits.

**beach replenishment:** the practice of artificially supplying sand to the shoreline to offset erosion caused by coastal storms, shoreline protection structures or other human activities (e.g., dredging) that interfere with the natural resupply of sand to the shoreline.

**buffer:** a horizontal distance separating a coastal feature or resource from human activities and within which activities may be regulated or controlled in order to protect the resource or minimize the risk of creating a coastal hazard.

**coastal erosion:** the landward displacement of the shoreline caused by the forces of waves and currents.

**coastal property disclosure:** notification of coastal landowners and prospective landowners that property held in their name lies within a state's coastal zone, especially areas subject to flooding and erosion, and as such may be subject to regulation to minimize hazards to life and property.

**coastal state:** a U.S. state that lies within, or borders on, the Atlantic, Pacific or Arctic Ocean, the Gulf of Mexico, Long Island Sound, or one or more of the Great Lakes. The term also applies to Puerto Rico, the Virgin Islands, Guam, the Commonwealth of the Northern Mariana Islands and American Samoa.

**Coastal Zone Management Act of 1972, as amended:** the federal law that seeks to achieve a balance between the protection and use of resources in the U.S. coastal zone. States, territories and commonwealths participate voluntarily.

**coliform bacteria:** bacteria that, if present in water or sediment, indicate the possible presence of enteric pathogens of sewage origin. Fecal coliform bacteria, which indicate specifically the presence of fecal material, are a subset of the total coliform bacteria group.

**compensatory mitigation:** the enhancement, restoration or creation of a natural resource, most commonly wetlands, to offset the environmental loss of the resource.

**conservation easement:** a legal agreement between a property owner and a

conservation organization or government agency that protects the conservation value of a parcel of land by limiting the owner's use of, and changes to, the parcel, often in exchange for a fee or tax benefit. The participating organization agrees to monitor the property and enforce the restrictions.

**coral reefs:** calcium carbonate structures that are found generally in warm, shallow ocean waters and are built largely by invertebrate animals made up of colonized polyps. These formations can extend hundreds of meters in thickness and can survive millions of years. The living and growing part of the reef is a thin, fragile layer sitting atop the calcium carbonate formations.

**estuary:** a semi-enclosed coastal body of water having a free connection with the open sea and within which seawater is measurably diluted by freshwater from land drainage.

**fee simple acquisition:** the acquisition of full ownership interest of a piece of property with none of the rights of ownership outstanding or in the name of another.

**land and water resource management techniques:** management practices that use voluntary measures, incentives or other means of encouraging individuals, businesses, interest groups or governments to act in ways that foster the goals, objectives and policies of state coastal management programs.

**liability waiver:** a legal action relieving a landowner of liability for damages or injury to persons crossing or otherwise using the individual's land. In most cases, the government body taking the action assumes the liability.

**mitigation banking:** an administrative arrangement in which an entity plans and undertakes habitat improvement activities on a specific parcel of property to offset the adverse habitat impacts of nearby development projects.

**permit:** legal authorization that private individuals, and government and nongovernment bodies, must receive from either federal, state or local government before undertaking certain activities in coastal lands and waters.

**permit conditions:** legal requirements for permits to ensure that the permitted activity takes place within certain design and/or temporal parameters.

**planning tools:** activities (e.g., local government plans, special area management plans) that identify activities and uses as acceptable, acceptable with conditions or prohibited in specific areas, thereby increasing predictability in government permitting and funding decisions.

**public investment restrictions:** government policies that limit public funding of private or public projects (e.g., highways, sewage treatment plants) in inappropriate areas, such as coastal areas with high potential for hazards.

**public trust doctrine:** provides that the state holds in trust, for the benefit of the public, title to tidal and navigable freshwaters, the lands beneath, and the living resources inhabiting these waters, and establishes the public's right to use and enjoy these trust waters, lands and resources for a wide variety of public uses.

**public trust resources:** the navigable waters, lands beneath these waters up to the ordinary high water mark, and living resources that inhabit these lands and waters.

**regulatory measures (regulatory tools):** management techniques that are enforceable under state laws and regulations to implement the policies of state coastal management programs.

**restoration:** the reconstruction of natural coastal resources such as dunes or wetlands. Integral to the restoration is replication of the full range of functions and values of the naturally occurring resource.

**sea level rise:** the increase in elevation of the oceans and their contiguous

coastal water bodies. Sea level rise may enlarge the areas subject to coastal erosion and flooding, thus resulting in loss of coastal wetlands.

**setback:** a distance landward of some coastal feature (e.g., the mean high water mark, coastal wetlands) within which certain types of structures or activities are prohibited.

**shoreline stabilization restriction:** a regulatory measure that limits or prohibits the use of hard structures (e.g., seawalls, revetments) in the water or adjacent shorelands.

**special area management plan (SAMP):** a comprehensive plan providing for natural resources protection and reasonable economic growth. Plan contains a detailed statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone. Certain SAMPs include federal, state and local government agencies in order to resolve complex resource management and land use issues.

**Submerged Lands Act:** the federal law that establishes title and ownership of lands and natural resources beneath navigable waters of the states. The seaward boundary of each state is a "line" three geographic miles from its coastline or, in the case of the Great Lakes states, to the international boundary.

**wetlands:** transitional lands of exceptional habitat value to fish, birds and other wildlife that exist between terrestrial and aquatic systems where the water table is usually at or near the surface. In coastal areas, wetlands may be continuously submerged by marine or estuarine waters, alternately exposed and flooded by tides of marine or estuarine waters, or influenced by nontidal freshwater. The vegetation of these areas often includes salt-marsh grasses or other salt-tolerant flora. In addition to their habitat value, wetlands also may act as pollution sinks and mitigate flood damage.
(top)

# CREDITS



## Acknowledgments

A number of individuals compiled and organized information for a series of national studies on the effectiveness of state coastal management programs, and the authors drew heavily from these reports. These included principal investigator James W. Good and research assistants John W. Weber, James W. Charland, John V. Olson and Kelly A. Chapin, who provided information on the techniques of managing coastal wetlands; principal investigator Tina Bernd-Cohen and research assistant Melissa Gordon, who developed national overview information on how states manage their coastal areas for hazards and how they protect beaches, dunes, bluffs and rocky shores; and Pamela Pogue and Virginia Lee, who examined various ways of providing public access to the shore. Without the information found in their reports, this essay could not have been written. The authors also wish to thank Laurie McGilvray from NOAA's Office of Ocean and Coastal Resources Management, and Thomas LaPointe, editor-in-chief of NOAA's State of the Coast Report, for their thoughtful, detailed review and suggestions.

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## Photo Credits

Many of the photos were gathered from NOAA archives or were generously provided from personal collections of NOAA staff members.Others were contributed from outside of NOAA, and we gratefully thank the following institutions and individuals:

**Photo 1.** Jim Whaley

**Photo 2.** Assateague Island National Seashore

**Photos 4 and 13.** Oregon Department of Land Conservation and Development

**Photo 7.** Ken Mallory, The New England Aquarium

**Figure 2.** InterNetwork Media, Inc.

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## About the Authors

William C. Millhouser earned a B.S. in psychology at the University of Illinois in 1964 and a master's of urban and regional planning at George Washington University in 1980. He has worked in NOAA's Office of Ocean and Coastal Resource Management (OCRM) since 1976 and is currently the Pacific Regional Manager in the Coastal Programs Division; in this capacity, he is responsible for implementing the Coastal Zone Management Act requirements in California, Oregon, Washington, Alaska, Hawaii, American Samoa, Guam and the Northern Mariana Islands. He has also worked with coastal management programs in the Gulf of Mexico, the Southeast and the Great Lakes region and, thus, has a comprehensive understanding of relevant regional and national issues. Mr. Millhouser has had lead responsibility for several OCRM projects addressing of a broad array of coastal zone management issues and state management responses, including urban waterfront redevelopment, hazard management, wetland protection and public access to the coast.

John McDonough has been a physical scientist with NOAA's Strategic Environmental Assessments Division since 1989. During that time, he has been instrumental in developing the Florida Keys National Marine Sanctuary Management Plan and a water quality protection program for Central Coastal California. Current ly, he is involved on the development of a special area management plan for Pea Patch Island Herony Region in Delaware Bay and on the development of a coastal data information management system to be used over the Internet.

John Paul Tolson has been a physical scientist with NOAA's Strategic Environmental Assessments Division for the past 17 years. During that time, he helped to develop the National Estuarine Inventory; the National Shellfish Register; desktop information systems with the states of Texas, Florida and Oregon; and two multimedia CD-ROMs on coastal issues. In the late 1970s, he spent four years working on the development of state coastal management programs with NOAA's Office of Coastal Zone Management. Prior to that, Mr. Tolson worked for two years with the Maryland coastal management program on the selection of potential sites for national estuarine research reserves.

**Photo not available**

David Slade is an environmental lawyer and consultant with many years of experience in coastal and marine law and policy. In addition, he is a marine ecologist. Mr. Slade was the Director of the Coastal States Organization (CSO) in Washington, DC from 1991 to 1996, representing the collective views of the governors of the 35 Atlantic, Gulf of Mexico, Pacific and Great Lakes states, as well as territories and commonwealths. Prior to becoming director, Mr. Slade was the general counsel of CSO. Before joining the CSO, he spent five years in NOAA's Office of General Counsel, working on the international moratorium of whaling, the regulation of the U.S. tuna industry and the associated "taking" of porpoise, fishery management and enforcement, coastal zone management, and endangered species protection.

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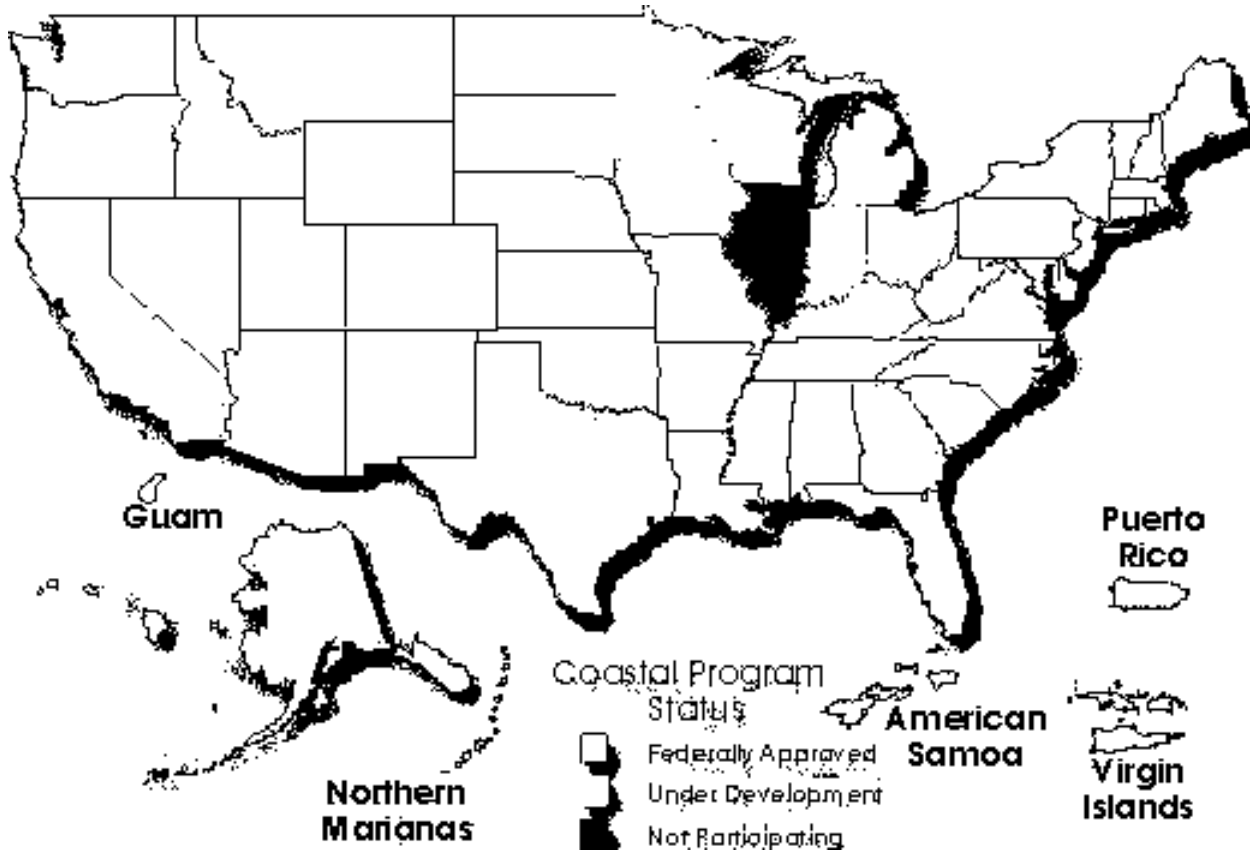


**Figure 1. State, territory and commonwealth participation in the Federal coastal zone management program.**

Note: American Samoa, Guam, Puerto Rico, the U.S. Virgin Islands, and the Northern Mariana Islands have federally approved coastal management programs.

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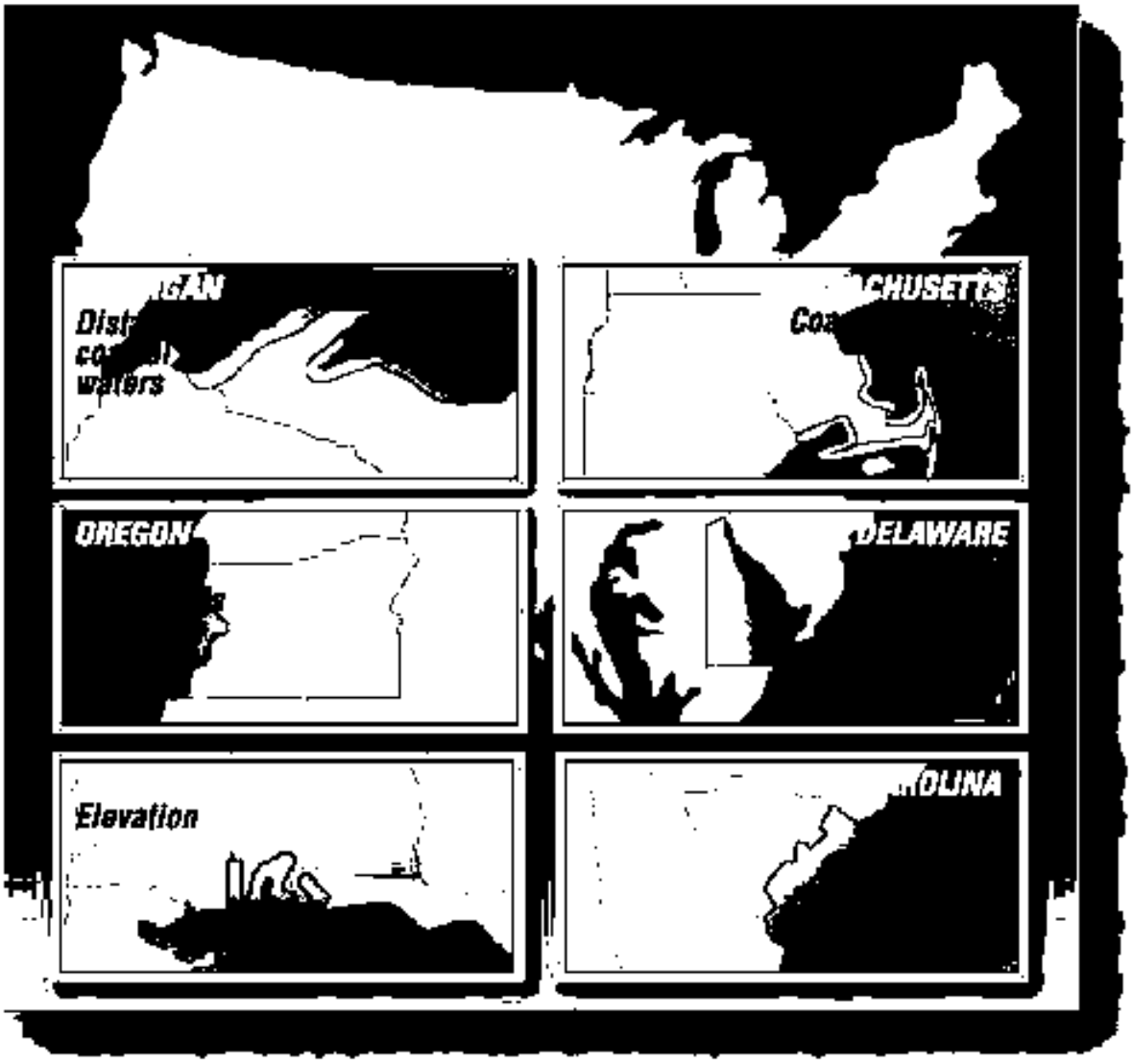


**Figure 2. Coastal states use different means to establish the inland extent of their coastal zone. Boundaries shown here are approximate and for the purpose of illustration only.**

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